Report #120

Red River Coal Company
Benthic Macroinvertebrate Survey
Spring 2013

Submitted To:

Roger Jones
P.O. Box 668
6999 Polk Road
Norton, Virginia 24273
United States of America

BMI

Submitted By:

Biological Monitoring, Inc.
1800 Kraft Drive, Suite 104
Blacksburg, VA 24060
Phone: 540-953-2821
Fax: 540-951-1481
Email: bmi@biomon.com

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EXECUTIVE SUMMARY

Biological Monitoring, Inc. (BMI) performed a stream survey in the South Fork Pound River Watershed for Red River Coal Company. The purpose of this survey was to conduct instream assessments as outlined in Red River's permits. Five instream monitoring stations were sampled.

The Virginia Stream Condition Index (VASCI) protocol was used for instream biological surveys. All biological sampling was performed in accordance with the Virginia Department of Game and Inland Fisheries' scientific collection permit requirements.

Samples were collected on May 13, 2013. Benthic samples were collected based on BMI's QAPP. All organisms were identified to the lowest practicable level and collapsed to the family level for VASCI calculation. The US EPA's Rapid Bioassessment Protocols for use in Wadeable Streams and Rivers was used for sampling macroinvertebrate populations and performing habitat assessments.

The analysis of the Spring 2013 survey data yielded VASCI scores ranging from 17.19 (RC-1) to 53.53 (GF1). Using the Virginia Department of Environmental Quality devised scale, these stations were classified in the "Severe Stress" and "Stress" Aquatic Life Use (ALU) Tiers. The habitat assessment scores ranged from 143 (SFP-2) to 151 (SFP-1, RC-1) falling into the "Suboptimal" category of habitat. Physicochemical and chemical analyses seem typical for mining influenced streams in the region.

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1.0 INTRODUCTION

Biological Monitoring, Inc. (BMI) performed a stream survey for Red River Coal Company in the South Fork Pound River Watershed located in Wise County, Virginia. The purpose of this survey was to conduct instream assessments in fulfillment of permit requirements. The present report provides the methods utilized and the results obtained from the May 13, 2013 sampling event.

BMI is a Tier III (VA) bio-monitoring facility as well as a National Environmental Laboratory Accreditation Program (NELAP) accredited Whole Effluent Toxicity Laboratory. BMI specializes in issues of water quality. Since 1980, BMI has been providing expertise in aquatic toxicology and risk assessment. Highly motivated and academically trained scientists at BMI work closely with clients to create practical solutions to environmental problems. BMI has maintained a commitment to the research and development of aquatic biomonitoring and toxicological concepts resulting in leading edge technologies and applications.

BMI interacts with regulatory agencies on behalf of its clients to solve specific environmental problems associated with water quality and toxicological regulations and permit compliance. With its main facilities located in Blacksburg, Virginia, BMI focuses on the development and application of procedures to create feasible solutions that balance the need for environmental protection and continued economic development.

2.0 METHODS AND MATERIALS

2.1 General

On May 13, 2013, samples were collected from several instream stations in the South Fork Pound River Watershed. Generally, instream stations were sampled for benthic macroinvertebrates as well as analytical and physicochemistry.

Grab samples were used for analytical and physicochemistry. Macroinvertebrate samples were collected following BMI's Biological Monitoring Program Quality Assurance Project Plan for Wadeable Streams and Rivers (QAPP) (BMI 2012). The Virginia Stream Condition Index (VASCI) protocol was used for this instream biological survey (Tetra Tech 2003). The US EPA's Rapid Bioassessment Protocols for use in Wadeable Streams and Rivers (RBP) was used for sampling macroinvertebrate populations and performing habitat assessments (USEPA 1999).

Qualitative habitat assessments were conducted at each bioassessment site by trained and experienced individuals. Physicochemical monitoring was performed in the field. Chemistry samples were collected and submitted to Environmental Monitoring, Inc. for analyses. This survey was conducted in accordance with Red River's permit conditions.

2.2 Station Location

Five instream monitoring stations were specified for this project. Station location was provided by the permittee. These stations were located in Wise County, Virginia and in the South Fork Pound River Watershed. Latitude and longitude coordinates were recorded at the downstream extent of the station using a Garmin® Global Positioning System portable unit (GPSMAP 60 CSX). Table 1 summarizes the monitoring station

attributes. Figure 1 provides a map of the area and the location of the monitoring stations. Figure 2 presents an orthophoto of study area. Station photographs are presented as Appendix A.

Table 1. Monitoring Station Attributes.

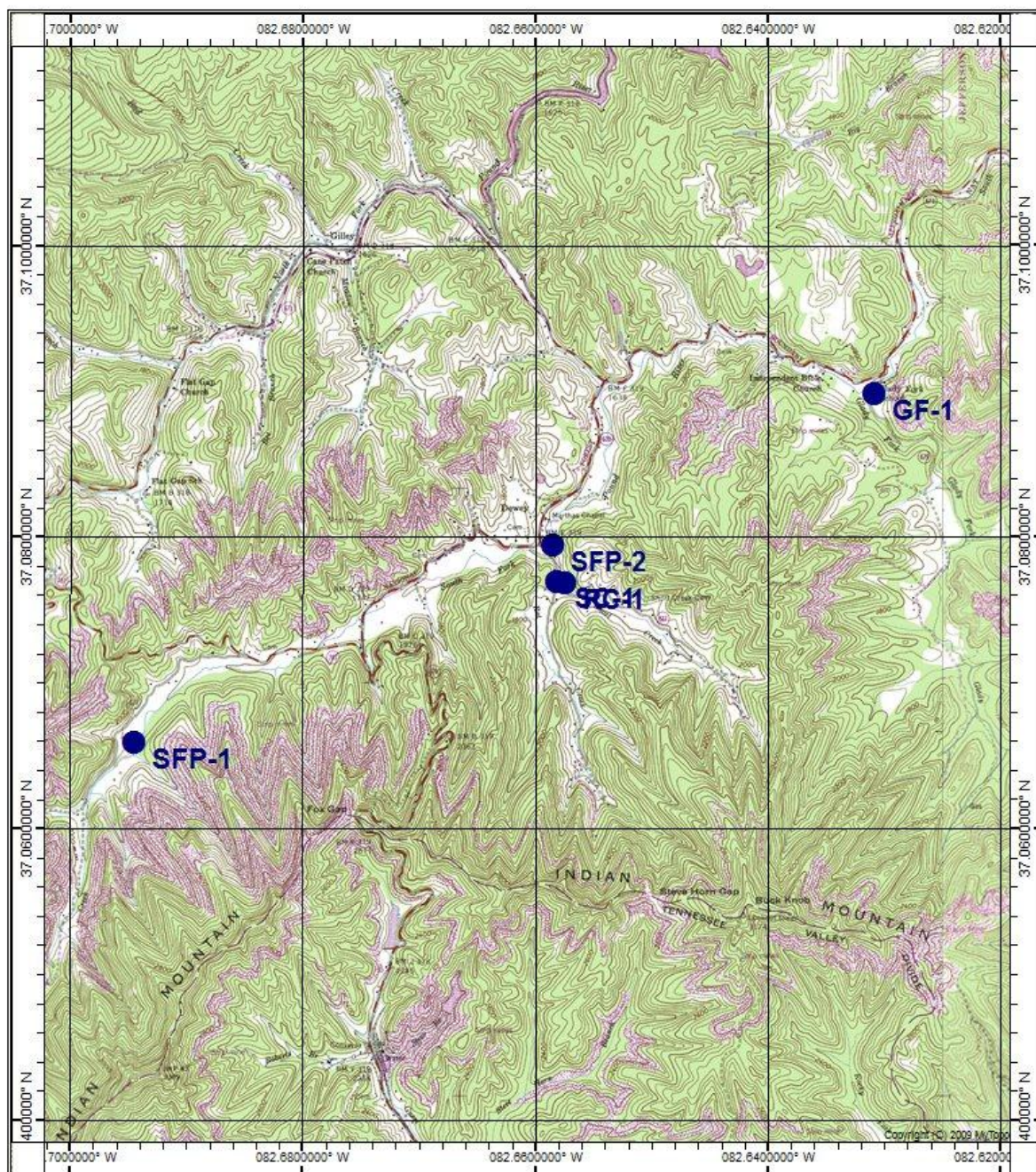| Station ID	Location Summary	Latitude	Longitude
SFP-1	Most upstream station	37° 03' 57.0"	82° 41' 40.6"
SFP-2	Downstream of confluence of Rat Creek and South Fork Pound River	37° 04' 45.9"	82° 39' 30.8"
SC-1	Mouth of Short Creek	37° 04 36.9"	82° 39' 29.4"
RC-1	Mouth of Rat Creek	37° 04' 36.3"	82° 39' 27.1"
GF-1	Mouth of Glady Fork	37° 05' 23.1"	82° 37' 51.4"

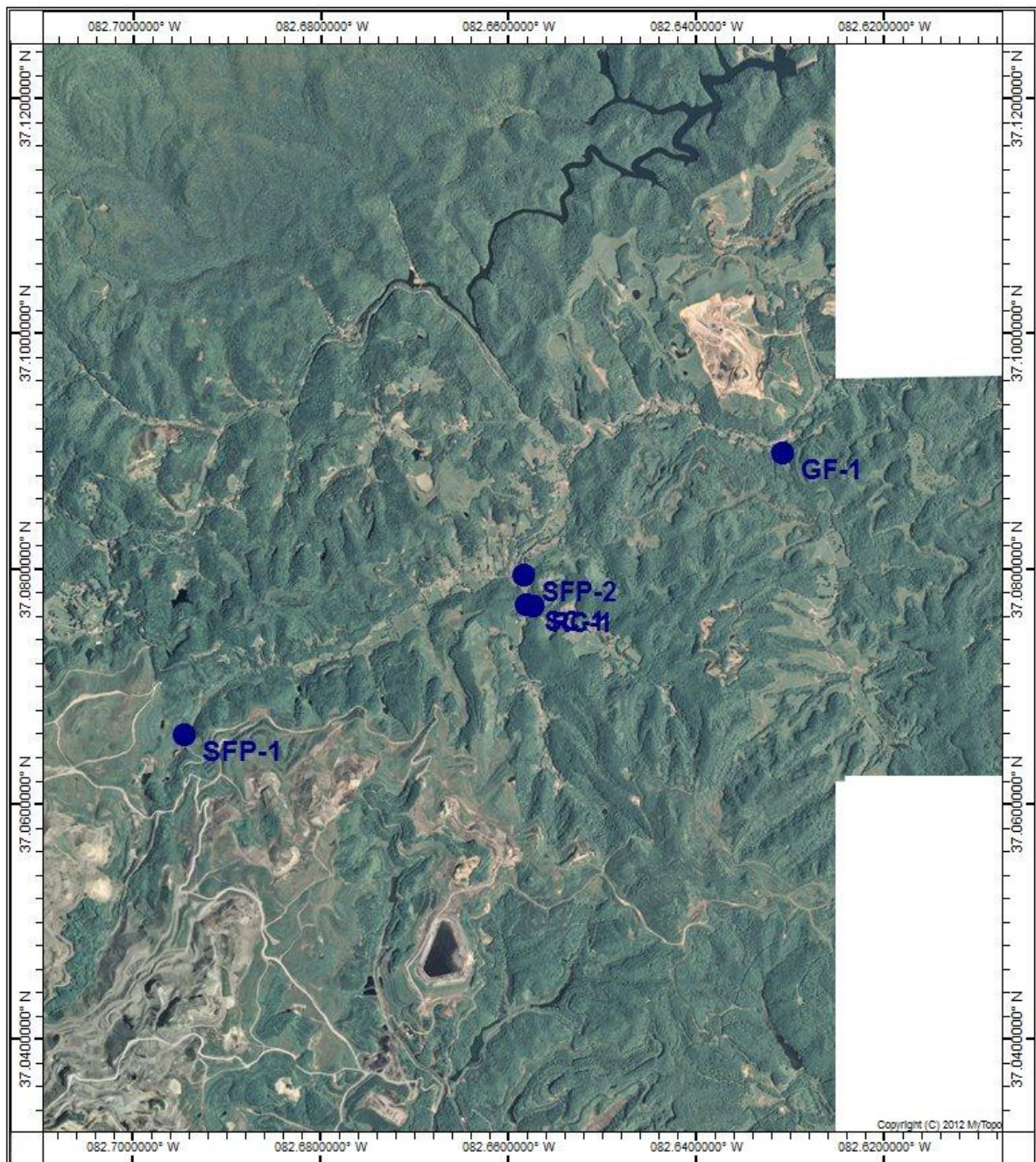**Figure 1.** Map of the Monitoring Stations.

Figure 2. Orthophoto of the Study Area

2.3 Macroinvertebrate Sampling & Assessment

2.3.1 Sampling & Identification

All biological sampling was performed in accordance with the Virginia Department of Game and Inland Fisheries' scientific collection permit requirements. Macroinvertebrates were collected at each benthic station following the single habitat approach (riffle-run) as presented in the QAPP (BMI 2012). Samples were collected using a semi-quantitative approach.

Four samples were collected at each station using a 0.50 m wide rectangular kick-net having a 500 μm mesh size. Each sample was collected by first placing the net on the bottom downstream of the 0.50 m^2 area to be sampled. Where appropriate, large rocks and debris were brushed off into the net and removed. The area to be sampled was then vigorously kicked for approximately 30 to 90 seconds or the Best Professional Judgment of the scientist. For each monitoring station, the four samples were rinsed, composited, placed in a labeled container, and preserved in 70% ethanol. Sample information was recorded on a BMI Sample Chain of Custody Form and returned to BMI's laboratory for enumeration and identification.

Organisms were separated from the debris in the laboratory. Subsampling was performed on each sample to a standard count of $110 \pm 10\%$. All organisms were identified to the lowest practicable level. Organism identification utilized the appropriate taxonomic keys (Merritt and Cummins 2008). All data analysis was performed at the family level in order to use the Virginia Stream Condition Index (VASCI). All organisms from this study will be retained for a period of at least five years.

2.3.2 Macroinvertebrate Data Assessment

Macroinvertebrate data were analyzed using *A Stream Condition Index for Virginia Non-Coastal Streams* (Tetra Tech 2003). This VASCI was developed from an analysis of data collected by the Virginia DEQ from 1994 to 1998 and 1999 to 2002. Using these data, VASCI designated statewide reference values were determined for each of the following eight metrics of community structure:

- **Total Number of Taxa** measures the total number of distinct taxa and, therefore, is representative of the diversity within a sample. High diversity is a strong indicator of stream health and ability to sustain populations. This metric value is expected to decrease in response to increased perturbation.

- **Total Number of EPT Taxa** is a measure of the total number of distinct taxa within the Orders Ephemeroptera, Plecoptera, and Trichoptera. These orders include the mayflies, stoneflies, and caddis flies, respectively. Organisms in these three orders have low tolerances to perturbation. As a result, the value of the metric is expected to decrease in response to increasing perturbation.

- **Percent Ephemeroptera** is the percentage of individual Ephemeroptera (mayflies) within a sample. This metric is calculated by dividing the number of Ephemeroptera by the total number of sample organisms. This metric indicates the relative abundance of this sensitive order within the stream community. The value of this metric is expected to decrease in response to increasing perturbation.

- **Percent P T Less Hydropsychidae** is the percentage of individuals from the orders Plecoptera and Trichoptera "less" the individuals from the family Hydropsychidae. This metric is calculated by dividing the number

of organisms from the orders Plecoptera and Trichoptera (less Hydropsychidae) by the total number of sample organisms. This metric indicates the relative abundance of these sensitive orders within the stream community. The value of this metric is expected to decrease in response to increasing perturbation.

• **Percent Scrapers** is percent abundance of individuals in the sample whose primary functional mechanism for obtaining food is to graze on substrate or periphyton, attached algae and associated material within a sample. This metric is calculated by dividing the number of organisms from the functional feeding group "scrapers" by the total number of sample organisms. The value of this metric is expected to decrease in response to increasing perturbation.

• **Percent Chironomidae** is the percent individual organisms of the Family Chironomidae within a sample. The metric is calculated by dividing the number of Chironomidae organisms by the total number of sample organisms. Family Chironomidae, the midges, are tolerant to perturbation and their relative abundance tends to increase in impacted streams. As a result, the value of this metric is expected to increase in response to increasing perturbation.

• **Percent Two Dominant Taxa** is the percentage of total individuals in the two taxa with the greatest number of organisms. The metric is calculated by adding the number of organisms present in the two largest taxa. Dividing this sum by the total number of organisms yields the relative abundance of the two dominant taxa. Samples with populations concentrated into a few taxa may be an indication of impact. This metric is expected to increase in response to increasing perturbation.

• **Hilsenhoff Biotic Index** (HBI) was originally designed to evaluate organic pollution by utilizing tolerance values to weight taxa abundance. The

resulting HBI value is an estimation of overall pollution level. The metric

is expected to increase in response to increasing perturbation.

The VASCI metrics and their expected response to perturbation are summarized in Table 2.

Table 2. VASCI Metrics and Expected Responses.

Metric	Expected Response
Total Number of Taxa	Decrease
Total Number of EPT Taxa	Decrease
Percent Ephemeroptera	Decrease
Percent PT Less Hydropsychidae	Decrease
Percent Scrapers	Decrease
Percent Chironomidae	Increase
Percent Two Dominant Taxa	Increase
Hilsenhoff Biotic Index	Increase

VASCI scores for each of the monitoring stations were calculated by dividing each station's metric values by the corresponding VASCI statewide reference values. This yielded a percentage score for each metric relative to the statewide reference condition. If the percentage score of any individual metric was greater than 100, the score was truncated to 100. The eight resulting values were then averaged to arrive at the VASCI score for each station.

2.4 Habitat Assessment

Habitat assessments were performed at each benthic station where macroinvertebrates were collected. These assessments were performed as per the RBP (USEPA 1999). Ten

habitat parameters were assessed, each receiving a score of 0 – 20. A description of each of the habitat parameters follows:

- **Epifaunal Substrate / Available Cover** rate the availability of structures in the stream that can be utilized as refuge, spawning, and feeding sites by macroinvertebrates. Examples of such structures would include boulders, cobble, undercut banks, roots, logs and branches.   The availability of cover can be a limiting factor on stream diversity and abundance.

- **Embeddedness** rate the degree to which coarse substrate such as gravel; cobble and boulders are sunken into the sand, silt and mud substrate of the stream bottom. Embeddedness is the result of sediment movement and deposition. Increased embeddedness reduces the available refuge, feeding and spawning sites available to macroinvertebrates resulting in lower diversity and abundance.

- **Velocity / Depth Regimes** gauge the presence or absence of four velocity-depth patterns. These patterns are slow-deep, slow-shallow, fast-deep, and fast-shallow. Ideally, all four patterns should be present to best provide a stable diverse stream community.

- **Sediment Deposition** rates the degree to which new sediment has accumulated in pools, point bars and islands. Sediment deposition may be an indicator of an unstable environment and lowered diversity.

- **Channel Flow Status** rates the degree to which water fills the stream channel. Channel flow status may be affected by obstructions, diversions or widening of the stream channel. As less of the channel is filled by water, the amount of suitable substrate is also reduced.

- **Channel Alteration** rate the degree to which the shape of the stream channel has been altered.   Alterations may include bridges, roads, diversion channels, channel straightening, artificial embankments, riprap,

dams, weirs, and other instream structures. Channel alteration often results in scouring and loss of available habitat.

- **Frequency of Riffles (or Bends)** rates the presence of quality riffle or sinuous habitat. Riffles and sinuous streams provide quality habitat for stable, diverse communities.

- **Bank Stability** indicates the degree to which banks have eroded or may erode. Eroded banks are a sign of sediment movement and deposition, which leads to reduced epifaunal habitat. Unstable banks may also point to poor vegetative cover.

- **Bank Vegetative Protection** gauges the extent of vegetative protection at the stream bank and the nearby riparian zone. Bank vegetation plays a vital role in erosion control, nutrient uptake, stream shading, and food supply.

- **Riparian Vegetative Zone Width** measures the extent of natural vegetation from the stream through the riparian zone. Wide vegetative zones provide pollution buffering, erosion control, habitat, nutrient uptake and nutrient input. These beneficial contributions can be impaired by commercial and residential development, roads, pastures, actively worked fields, etc.

Table 3 identifies each of the ten Habitat Assessment Parameters and their range of scores. Scores for each parameter were recorded on Habitat Assessment Field Log Sheets (USEPA 1999). The habitat assessment score for each station was calculated by adding the score for each parameter yielding a station total. The highest attainable score was 200. The actual habitat assessment process involves rating the ten parameters as optimal (>153), suboptimal (101-153), marginal (46-100), or poor (<45).

Table 3. Habitat Assessment Parameters

Parameter	Description	Scoring
1	Epifaunal Substrate / Available Cover	0-20
2	Embeddedness	0-20
3	Velocity / Depth Regime	0-20
4	Sediment Deposition	0-20
5	Channel Flow Status	0-20
6	Channel Alteration	0-20
7	Frequency of Riffles or Bends	0-20
8	Bank Stability	Left 0-10
		Right 0-10
9	Vegetative Protection	Left 0-10
		Right 0-10
10	Riparian Vegetative Zone Width	Left 0-10
		Right 0-10

2.5   Physicochemical Assessment

Prior to any field data collections, all handheld meters were calibrated. Conductivity (µS), Dissolved Oxygen (mg/L), pH (SU) and temperature (°C) were recorded at each of the sample stations, where appropriate.   Conductivity, Dissolved Oxygen, pH and Temperature were all recorded using calibrated field meters. Field meters included an Oakton PCTestr 35 combination pH/EC/TDS/Temperature Meter and a Hanna model HI 9142 Dissolved Oxygen Meter.

2.6   Chemical Monitoring

Samples for analytical chemistry were collected and analyzed by Environmental Monitoring, Inc.

3.0 RESULTS

3.1 Station Location

Station attributes, including latitudes and longitudes are presented in Table 1 and depicted in Figures 1 and 2. Station photographs are presented in Appendix A. Flow was adequate for sampling at all stations.

3.2 Macroinvertebrate Monitoring Data

3.2.1 Virginia Stream Condition Index Metrics

The 110 ± 10% subsample is summarized in Table 4. The VASCI metric values for the monitoring stations sampled are summarized in Table 5. Raw data are presented in Appendix B.

Table 4. Identification / Enumeration Data

Order	Family	SFP1	SFP2	GF1	SC1	RC1
Coleoptera						
	Elmidae	2			1	
Diptera						
	Ceratopogonidae				1	1
	Chironomidae	60	60	11	44	93
	Empididae	5	1	2	6	2
	Simuliidae	5	55	3		
	Tipulidae			1	3	2
Ephemeroptera						
	Baetidae	2	1			
	Ephemerellidae				1	
Hemiptera						
	Saldidae				1	
Megoloptera						
	Sialidae	1				
Plecoptera						
	Leuctridae	8		82	45	2
	Nemouridae	2		5		
	Perlidae	2		1		
	Perlodidae				1	
Trichoptera						
	Hydropsychidae	12		6		9
	Philopotamidae			1		
	Rhyacophiloidea			2	2	
Other Taxa						
	Asellidae				1	
	Cambaridae				1	1
	Oligochaeta	3	1	1	1	1
	Totals	**102**	**118**	**116**	**108**	**110**

Table 5. VASCI Metrics.

	SFP-1	SFP-2	SC-1	RC-1	GF-1
Total Taxa	5	10	10	6	12
EPT Taxa	1	5	4	2	6
%Ephemeroptera	0.85	1.96	0.93	0	0
%Plec+Tric less Hydropsych.	0	11.76	44.44	1.82	78.45
%Scrapers	0	1.96	0.93	0	0
%Chironomidae	50.85	58.82	40.74	84.55	9.48
% Top 2 Dominant	97.46	70.59	91.67	92.73	80.17
HBI (Family)	6.00	5.30	3.20	5.85	1.40

3.2.2   Virginia Stream Condition Index Scores

Table 6 presents a summary of the VASCI scoring. Raw data are presented in Appendix B. Each metric score represents a percentage of the statewide reference condition. The VASCI scores calculated ranged from 17.19 (RC-1) to 53.53 (GF1).

Table 6. VASCI Scoring.

	SFP-1	SFP-2	SC-1	RC-1	GF-1
Total Taxa	22.73	45.45	45.45	27.27	54.55
EPT Taxa	9.09	15.15	36.36	18.18	54.55
%Ephemeroptera	1.38	3.20	1.51	0	0
%Plec+Tric less Hydropsych.	0	33.05	100	5.11	100
%Scrapers	0	3.80	1.79	0	0
%Chironomidae	49.15	41.18	59.26	15.45	90.52
% Top 2 Dominant	3.67	42.50	12.04	10.51	28.65
HBI (Family)	58.82	69.12	100	61.03	100
VASCI	**18.11**	**35.47**	**44.55**	**17.19**	**53.53**

Figure 3 is a graphical representation of the VASCI score(s) along with the Aquatic Life Use Tiers. It should be noted that four tiers exist in the VASCI, whereas, a score of 60 or higher is considered "unimpaired" and a score of < 60 is considered "impaired".
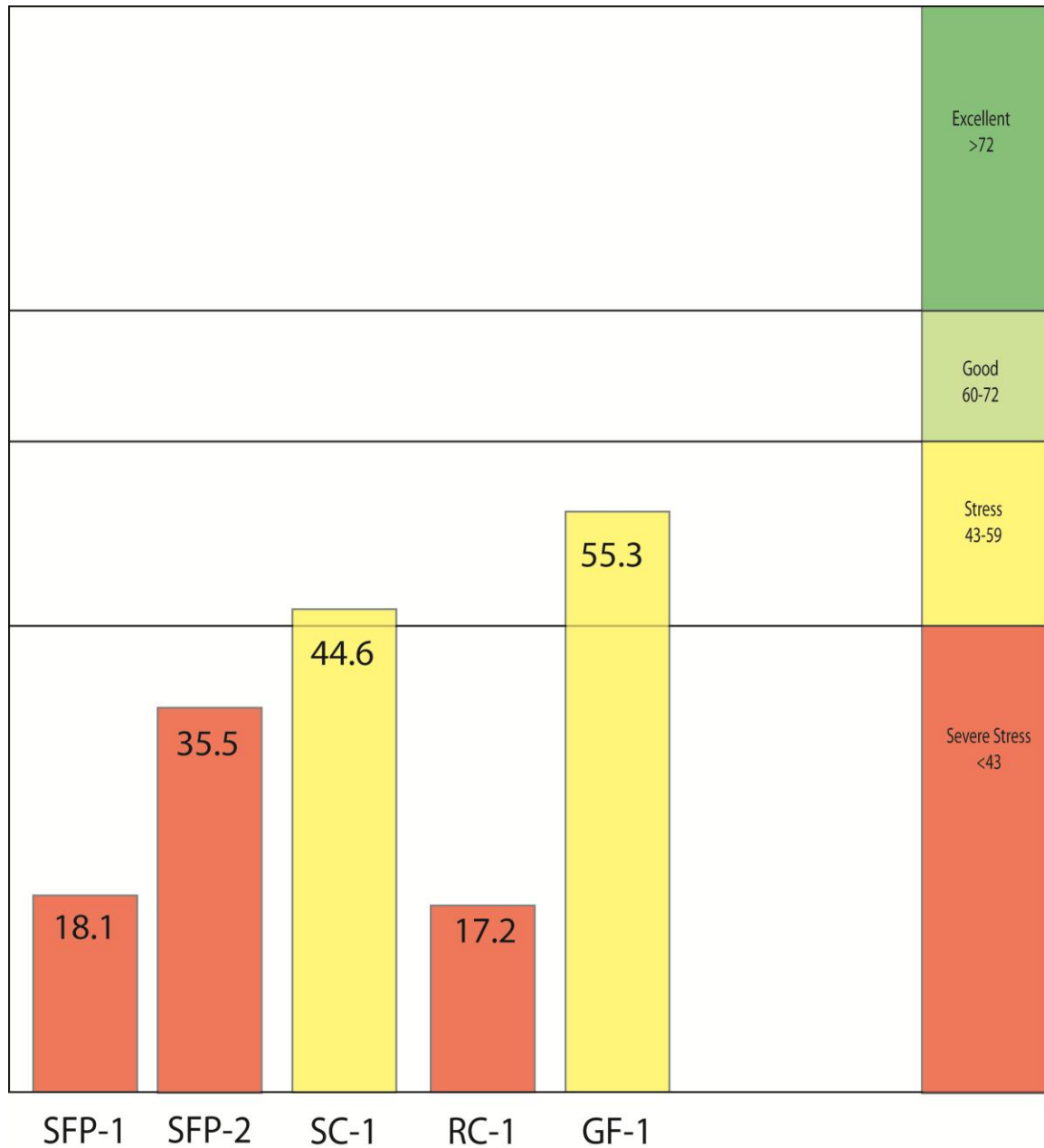
Figure 3. VASCI Scoring Summary

3.3   Habitat Assessment

Table 7 presents a summary of the habitat assessment score for the monitoring stations. Raw data are presented in Appendix B. The habitat assessment scores ranged from 143 (SFP-2) to 151 (SFP-1, RC-1) falling into the "Suboptimal" category of habitat.

Table 7. RBP Habitat Scoring.

Parameter	SFP-1	SFP-2	SC-1	RC-1	GF-1
Subst./Cover	15	19	16	18	17
Embeddedness	9	11	16	13	16
Velocity	15	15	15	15	16
Sediment Dep.	17	13	14	15	10
Channel Flow	20	20	19	19	19
Channel Alt.	13	13	11	15	15
Freq of Riffles	17	19	19	20	18
Bank Stab L	9	8	9	9	8
Bank Stab R	9	10	10	9	5
Veg. Prot. L	6	10	5	9	10
Veg. Prot. R	10	2	10	1	3
Rip. Zone L	1	3	0	8	10
Rip. Zone R	10	0	4	0	1
Total	**151**	**143**	**148**	**151**	**148**

Figure 4 is a visual representation of the habitat score(s) obtained for this permit along with the different tiers.
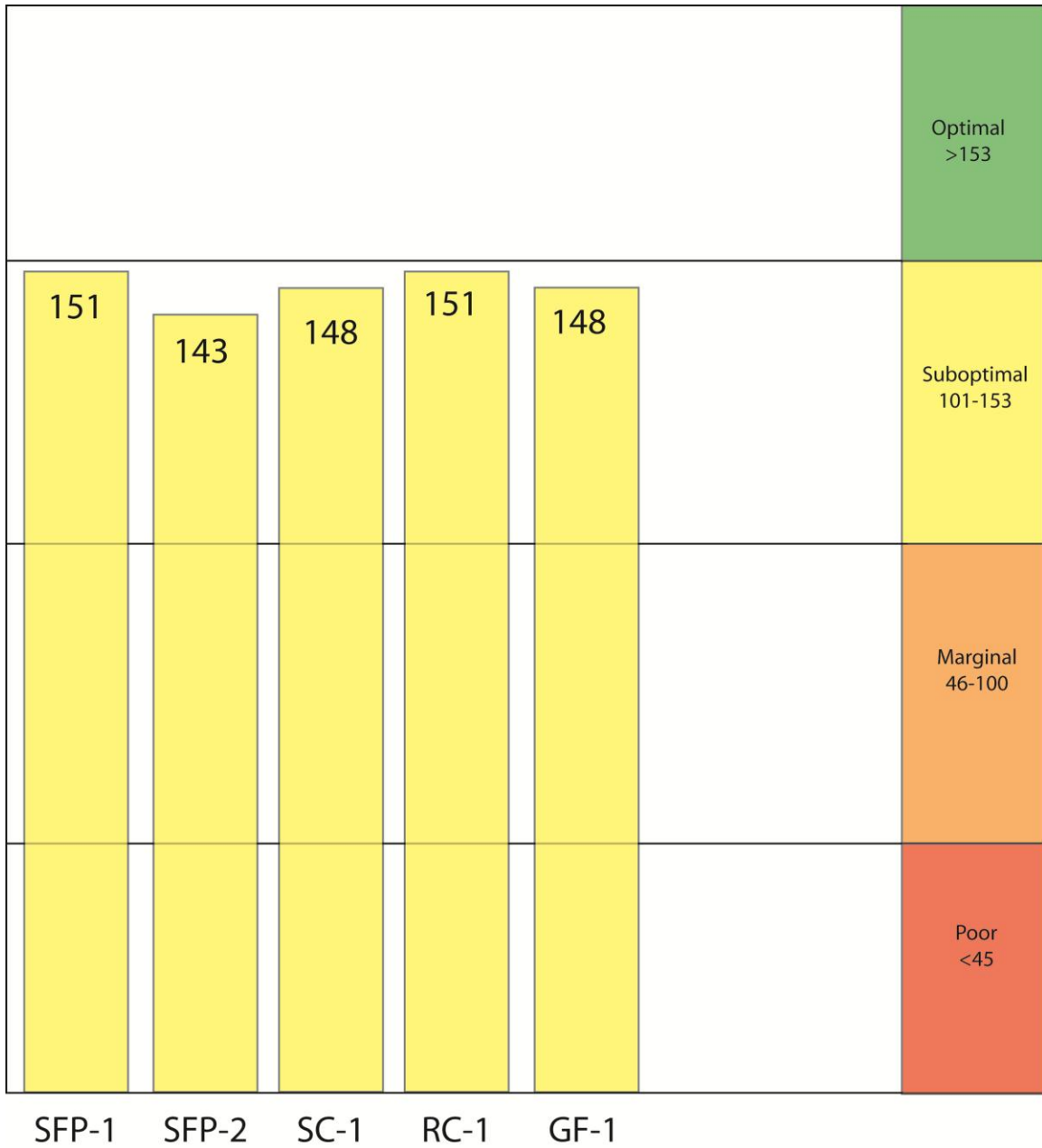
Figure 4. Habitat Scoring Sumary

3.4 Water Quality Assessment

Table 8 presents the water quality assessments.

Table 8. Water Quality Analyses.

	SFP-1	SFP-2	SC-1	RC-1	GF-1
Conductivity (µS/cm)	2160	1984	302	1380	551
Dissolved Oxygen (mg/L)	8.4	8.4	8.9	8.8	8.6
pH (SU)	7.6	8.4	8.0	8.0	8.1
Temperature (°C)	13.5	13.9	12.8	13.2	11.5
Flow (cfs)	22.31	49.06	1.97	2.03	9.73

3.5 Chemical Monitoring

Results from the chemical monitoring are not included in this report. Results will be provided by Environmental Monitoring, Inc. separately.

4.0 DISCUSSION

Water quality and both instream and riparian habitat are important determinants of the composition, structure, and function of biotic communities. The instream water quality assessments and the RBP Habitat Assessment techniques used in this study do not provide adequate discriminatory power to differentiate cause and effect. A systematic assessment of instream and riparian habitat quality is necessary to fully assess water quality conditions in streams and rivers (USEPA 1999).

4.1 Station Location

Since the sampling locations were presumably specified in the permit, it is assumed that they are representative of the permit in question. Furthermore, this study represents a significant component of the holistic watershed management approach cited in DMLR Guidance Memorandum 32-10 Revised (DMLR 2011).

4.2 Macroinvertebrate Data

The VASCI values in this study should be considered a relative ranking, indicating the comparability of the studied stream to the statewide reference for least disturbed streams. As such, these values should not be considered an absolute rating.

The VASCI validation document recommends Aquatic Life Use tiers based on the VASCI scores (VADEQ 2006). These tiers and their respective scores are as follows:

- ➢ "Severe Stress indicates scores below 43;
- ➢ "Stress" indicates scores from 43 to 59;
- ➢ "Good" conditions indicate scores from 60 to 72; and
- ➢ "Excellent" stream quality is represented by scores above 72.

The VASCI scores calculated for this permit ranged from 17.19 (RC-1) to 53.53 (GF1). These scores fall into the "Severe Stress" and "Stress" Aquatic Life Use tiers.

4.3 Habitat Assessment

Habitat plays an important role in species composition, various assemblages and numbers of organisms found in aquatic environments. To make meaningful impact analyses, one must consider habitat data as a possible limiting factor. The habitat assessment scores ranged from 143 (SFP-2) to 151 (SFP-1, RC-1) falling into the "Suboptimal" category of habitat.

RBP habitat assessment techniques are qualitative in nature and designed to determine comparability and ranking amongst stations. Traditionally, this approach assumes the presence of a reference station for the data set. To further explore the role habitat may be playing on the benthic score; additional data will have to be collected.

4.4 Water Quality Assessment

The water chemistry parameters examined, conductivity, pH, temperature and flow, were typical for streams influenced by urban environments and mining in the region.

5.0 LITERATURE CITED

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Buchanan, T.J., and Somers, W.P., 1969, Discharge measurements at gaging stations: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap A8, 65 p.

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Virginia Department of Environmental Quality (2006) *Using Probabilistic Monitoring Data to Validate the Non-Coastal Virginia Stream Condition Index;* VDEQ; Richmond, VA.

APPENDIX A:

STATION PHOTOGRAPHS

SFP-1
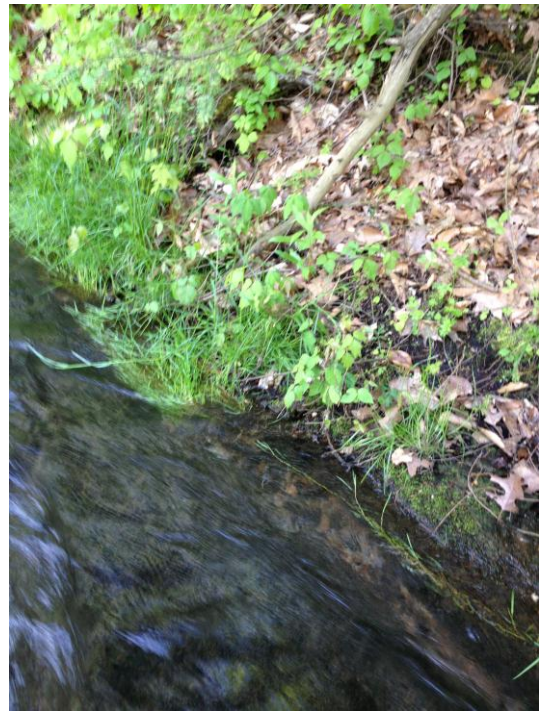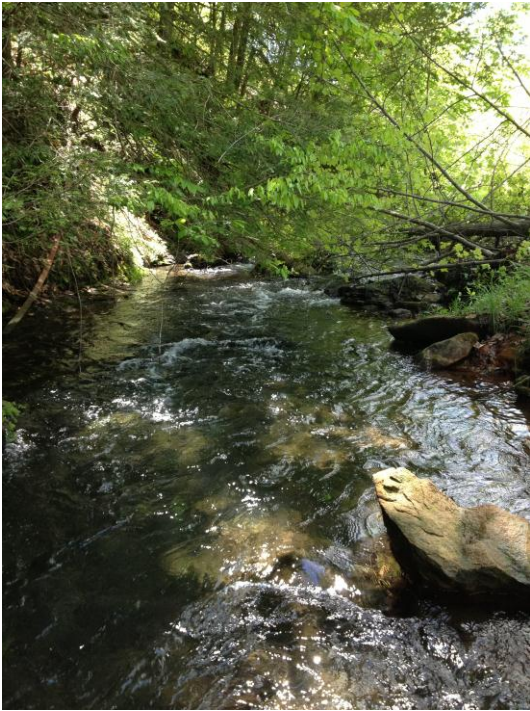
SFP-2
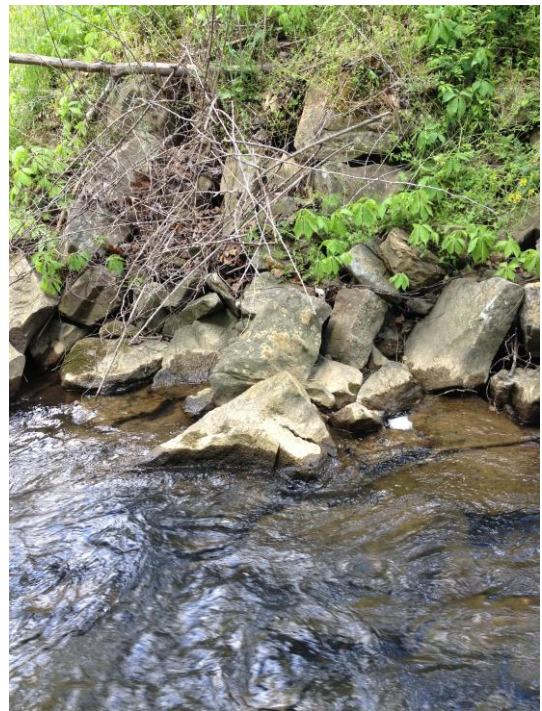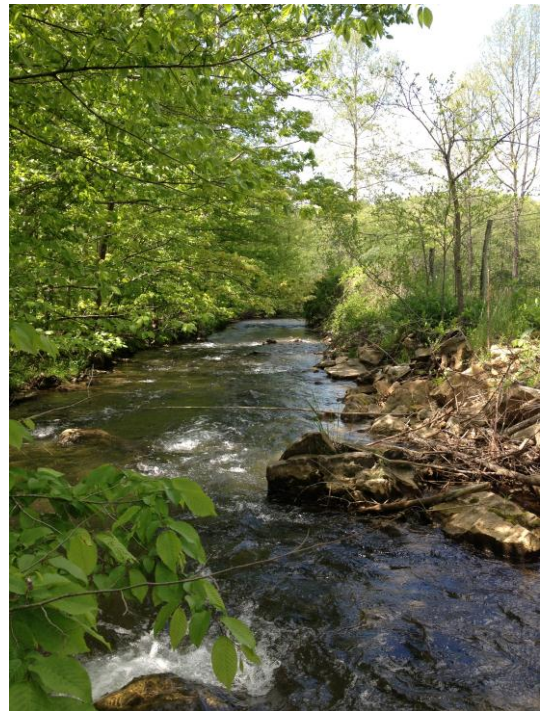
SC-1

RC-1
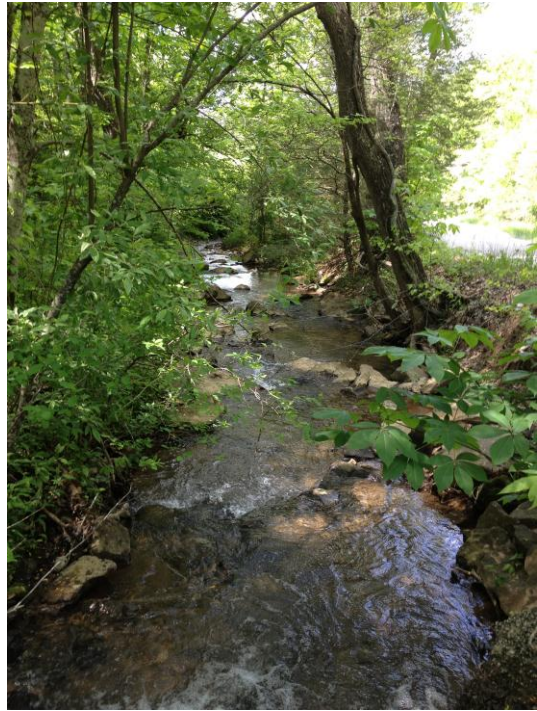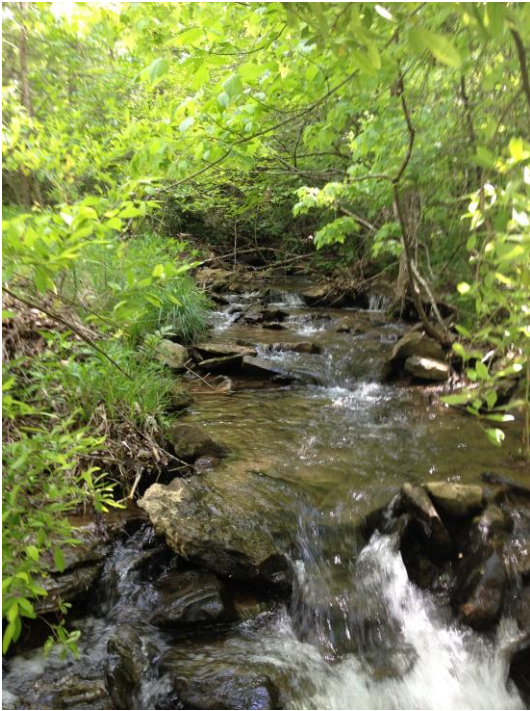
GF-1
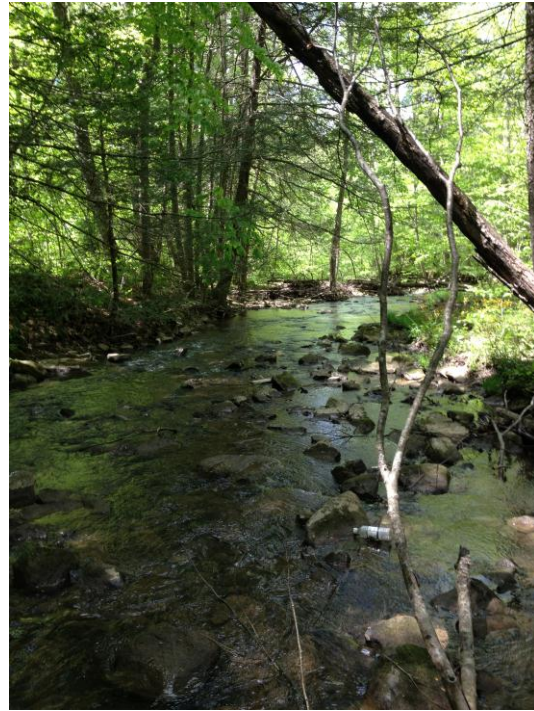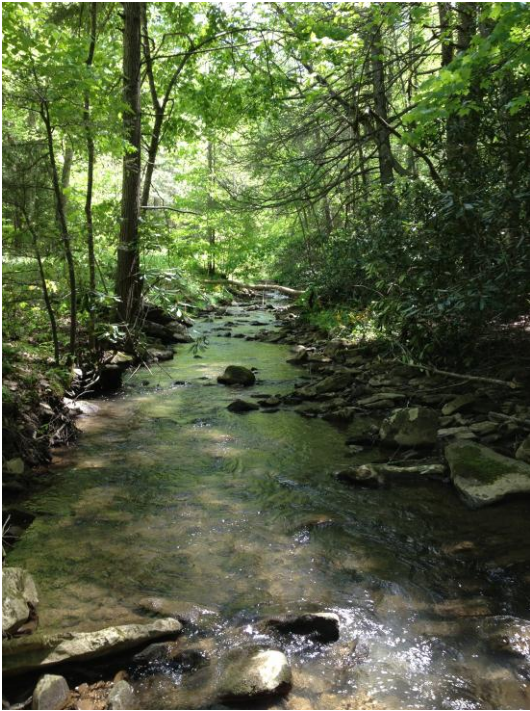
APPENDIX B:

RAW DATA

Station
SFP1

Total Hydropsychidae	Total Ephemeroptera	Total Scrapers	Total Chironomidae	Total PT	Abundance	Total Taxa	EPT Taxa
0.00	1.00	1.00	60.00	0.00	118.00	5.00	1.00

% Ephemeroptera	% PT less Hydropsychidae	% Scrapers	% Chironomidae	Two Dominant Taxa #	% Top two dominant taxa	FFG #	HBI (Family)
0.85	0.00	0.00	50.85	115.00	97.46		6.00

SFP1

	VASCI Metrics vs. Standard	VASCI Metrics (Truncated)
Number of Taxa	22.73	22.73
Number of EPT Taxa	9.09	9.09
Percent E	1.38	1.38
Percent PT Less Hydropsychidae	0.00	0.00
Percent Scrapers	0.00	0.00
Percent Chironomidae	49.15	49.15
Percent Two Dominant	3.67	3.67
Hilsenhoff Biotic Index	58.82	58.82

Raw VASCI	Final VASCI
18.11	18.11

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME S Fork Pound	LOCATION Water Fill Station
STATION # SFP 2 RIVERMILE	STREAM CLASS
LAT SFP1 LONG	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS JR WB	
FORM COMPLETED BY JR	DATE 5/13/13 TIME 1245 AM (PM) REASON FOR SURVEY

WEATHER CONDITIONS	Now	Past 24 hours	Has there been a heavy rain in the last 7 days? ☐ Yes ☐ No
	☐ storm (heavy rain)	☐	
	☐ rain (steady rain)	☐	Air Temperature ____ °C
	☐ showers (intermittent)	☐	
	%☐ %cloud cover	☐ %	Other _____
	☑ clear/sunny	☐	

SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)

Pics

142-147

Flow

	D	V	
LC	0.80	1.80	6.235

pH 7.6

| C | 1.1 ft | 2.48 | 11.812 |

DO 8.41

| RC | 0.40 | 2.46 | 4.261 |

Cond 2160

Width 13 ft   22.31 ft³/s

Temp 13.5°C

4.33 x L x W

STREAM CHARACTERIZATION	Stream Subsystem ☑Perennial ☐ Intermittent ☐ Tidal	Stream Type ☐ Coldwater ☑ Warmwater
	Stream Origin ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☑ Mixture of origins ☐ Other ____	Catchment Area ____ km²

Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition - Form 1

A-5

SFP1

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☑ Industrial ☐ Agricultural ☐ Other _____ ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☑ Obvious sources **Local Watershed Erosion** ☐ None ☑ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present ☑ Trees ☑ Shrubs ☐ Grasses ☐ Herbaceous dominant species present _____
INSTREAM FEATURES	Estimated Reach Length _100_ m Estimated Stream Width _6_ m Sampling Reach Area _____ m² Area in km² (m²x1000) _____ km² Estimated Stream Depth _____ m Surface Velocity (at thalweg) _____ m/sec **Canopy Cover** ☐ Partly open ☑ Partly shaded ☐ Shaded High Water Mark _0.67_ m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle _50_ % ☐ Run _40_ % ☐ Pool _10_ % Channelized ☑ Yes ☐ No Dam Present ☐ Yes ☑ No LDB Road
LARGE WOODY DEBRIS	LWD _____ m² Density of LWD _____ m²/km² (LWD/ reach area)
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present ☑ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation _80_ %
WATER QUALITY	Temperature _____ °C Specific Conductance _____ Dissolved Oxygen _____ pH _____ Turbidity _____ WQ Instrument Used _____ **Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☑ Other _Sulphur_ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☑ None ☐ Other _____ **Turbidity (if not measured)** ☑ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☑ Other _Sulphur_ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☑ Other _silt_ Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	5
Boulder	> 256 mm (10")	5			
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	30			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	10			
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME SFP1	LOCATION
STATION # ~~SFP2~~ RIVERMILE	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 5/13/13 TIME 1245 AM PM REASON FOR SURVEY

<table>
<tr><td rowspan="2" style="writing-mode:vertical">Parameters to be evaluated in sampling reach</td><td rowspan="2">Habitat Parameter</td><td colspan="4">Condition Category</td></tr>
<tr><td>Optimal</td><td>Suboptimal</td><td>Marginal</td><td>Poor</td></tr>
<tr><td></td><td>1. Epifaunal Substrate/ Available Cover</td><td>Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and not transient).</td><td>40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).</td><td>20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.</td><td>Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.</td></tr>
<tr><td></td><td>SCORE</td><td>20 19 18 (17) 16</td><td>15 14 13 12 11</td><td>10 9 8 7 6</td><td>5 4 3 2 1</td></tr>
<tr><td></td><td>2. Embeddedness</td><td>Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.</td><td>Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.</td><td>Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.</td><td>Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.</td></tr>
<tr><td></td><td>SCORE</td><td>20 19 18 17 16</td><td>15 14 13 12 11</td><td>10 (9) 8 7 6</td><td>5 4 3 2 1</td></tr>
<tr><td></td><td>3. Velocity/Depth Regime</td><td>All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)</td><td>Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).</td><td>Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).</td><td>Dominated by 1 velocity/ depth regime (usually slow-deep).</td></tr>
<tr><td></td><td>SCORE</td><td>20 19 18 17 16</td><td>15 (14) 13 12 11</td><td>10 9 8 7 6</td><td>5 4 3 2 1</td></tr>
<tr><td></td><td>4. Sediment Deposition</td><td>Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.</td><td>Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.</td><td>Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.</td><td>Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.</td></tr>
<tr><td></td><td>SCORE</td><td>20 19 18 (17) 16</td><td>15 14 13 12 11</td><td>10 9 8 7 6</td><td>5 4 3 2 1</td></tr>
<tr><td></td><td>5. Channel Flow Status</td><td>Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.</td><td>Water fills >75% of the available channel; or <25% of channel substrate is exposed.</td><td>Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.</td><td>Very little water in channel and mostly present as standing pools.</td></tr>
<tr><td></td><td>SCORE</td><td>20 19 18 (16) 17</td><td>15 14 13 12 11</td><td>10 9 8 7 6</td><td>5 4 3 2 1</td></tr>
</table>

Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition - Form 2

A-7

SFP1

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____

Total Hydropsychidae	Total Ephemeroptera	Total Scrapers	Total Chironomidae	Total PT	Abundance	Total Taxa	EPT Taxa
12.00	2.00	2.00	60.00	24.00	102.00	10.00	5.00

% Ephemeroptera	% PT less Hydropsychidae	% Scrapers	% Chironomidae	Two Dominant Taxa #	% Top two dominant taxa	FFG #	HBI (Family)
1.96	1.96	11.76	58.82	72.00	70.59		5.30

SFP2

	VASCI Metrics vs. Standard	VASCI Metrics (Truncated)
Number of Taxa	45.45	45.45
Number of EPT Taxa	45.45	45.45
Percent E	3.20	3.20
Percent PT Less Hydropsychidae	33.05	33.05
Percent Scrapers	3.80	3.80
Percent Chironomidae	41.18	41.18
Percent Two Dominant	42.50	42.50
Hilsenhoff Biotic Index	69.12	69.12

Raw VASCI	Final VASCI
35.47	35.47

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME	LOCATION
STATION # SFP2 RIVERMILE	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS WB JR	
FORM COMPLETED BY	DATE 5-13-13 TIME _____ AM PM	REASON FOR SURVEY

WEATHER CONDITIONS	Now		Past 24 hours	Has there been a heavy rain in the last 7 days? ☒Yes ☐No
	☐	storm (heavy rain)	☐	Air Temperature 50 °C
	☐	rain (steady rain)	☐	
	☐	showers (intermittent)	☐	Other _____
	%☐	%cloud cover	☐ %	
	☒	clear/sunny	☒	

SITE LOCATION/MAP	Draw a map of the site and indicate the areas sampled (or attach a photograph)
	Pics 154-159
	Flow
	D V
	LC 0.6 — 3.11 11,812 pH 8.4
	C 0.9 — 2.90 16.521 cond 1984
	RC 1.25 — 2.62 20.731 DO 8.38
	49.06 ft³/s Temp 13.9
	Width 19'
	6.33 x L x W

STREAM CHARACTERIZATION	Stream Subsystem: ☒Perennial ☐Intermittent ☐Tidal	Stream Type ☐Coldwater ☒Warmwater
	Stream Origin: ☐Glacial ☐Spring-fed ☐Non-glacial montane ☒Mixture of origins ☐Swamp and bog ☐Other _____	Catchment Area _____ km²

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SFP2

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other _____ ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☐ Obvious sources **Local Watershed Erosion** ☐ None ☐ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present ☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous dominant species present _____
INSTREAM FEATURES	Estimated Reach Length __100__ m Estimated Stream Width _____ m Sampling Reach Area _____ m² Area in km² (m²x1000) _____ km² Estimated Stream Depth _____ m Surface Velocity _____ m/sec (at thalweg) **Canopy Cover** ☐ Partly open ☒ Partly shaded ☐ Shaded High Water Mark __0.1__ m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle _100_ % ☐ Run _30_ % ☐ Pool _10_ % Channelized ☐ Yes ☐ No Dam Present ☐ Yes ☒ No
LARGE WOODY DEBRIS	LWD _____ m² Density of LWD _____ m²/km² (LWD/ reach area)
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☒ Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation _60-70_ %
WATER QUALITY	Temperature _____ ° C Specific Conductance _____ Dissolved Oxygen _____ pH _____ Turbidity _____ WQ Instrument Used _____ **Water Odors** ☒ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other _____ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☒ None ☐ Other _____ **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ **Oils** ☐ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other _____ Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☐ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

STREAM NAME		LOCATION	
STATION # 5FP2	RIVERMILE	STREAM CLASS	
LAT	LONG	RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS			
FORM COMPLETED BY		DATE 5/13/13 TIME ___ AM PM	REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 (11)	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	(20) 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Parameters to be evaluated in sampling reach

Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition - Form 2

A-7

Parameters to be evaluated broader than sampling reach

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) — Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4	3 2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4	3 2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4	3 2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4	3 2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4	3 2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4	3 2 1 0

Total Score _____

Station
SC1

Total Hydropsychidae	Total Ephemeroptera	Total Scrapers	Total Chironomidae	Total PT	Abundance	Total Taxa	EPT Taxa
0.00	1.00	1.00	44.00	48.00	108.00	10.00	4.00

% Ephemeroptera	% PT less Hydropsychidae	% Scrapers	% Chironomidae	Two Dominant Taxa #	% Top two dominant taxa	FFG #	HBI (Family)
0.93	0.93	44.44	0.93	40.74	99.00	91.67	3.20

SC1

	VASCI Metrics vs. Standard	VASCI Metrics (Truncated)
Number of Taxa	45.45	45.45
Number of EPT Taxa	36.36	36.36
Percent E	1.51	1.51
Percent PT Less Hydropsychidae	124.84	100.00
Percent Scrapers	1.79	1.79
Percent Chironomidae	59.26	59.26
Percent Two Dominant	12.04	12.04
Hilsenhoff Biotic Index	100.00	100.00

Raw VASCI	Final VASCI
47.66	44.55

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME	LOCATION
STATION # SC 1 RIVERMILE	STREAM CLASS
LAT ___ LONG ___	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS WB JR	
FORM COMPLETED BY	DATE 5-13-13 TIME 1600 AM PM	REASON FOR SURVEY

WEATHER CONDITIONS	

Now

☐ storm (heavy rain)
☐ rain (steady rain)
☐ showers (intermittent)
___ %☐ %cloud cover
☒ clear/sunny

Past 24 hours

☐
☐
☐
☐
☒ %

Has there been a heavy rain in the last 7 days?
☒ Yes   ☐ No

Air Temperature 55 °C

Other _____

SITE LOCATION/MAP

Draw a map of the site and indicate the areas sampled (or attach a photograph)

PICS 166-171

$$
\begin{array}{llll}
 & D & V & \\
RC & 0.3 \_ 0.56 & \bullet336 & \\
C & 0.2 \_ 0.85 & \bullet340 & \\
LC & 0.35 \_ 1.85 & 1.295 & \\
\end{array}
$$

pH 8.0
cond 302
DO 8.92
Temp 12.8

Width 6'
1.971 cfs

2×L×W.

STREAM CHARACTERIZATION		
Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal		**Stream Type** ☐ Coldwater ☒ Warmwater
Stream Origin ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog	☐ Spring-fed ☒ Mixture of origins ☐ Other ___	**Catchment Area** ___ km²

Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition - Form 1   A-5

SC1

LDB Road

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other _____ ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☐ Obvious sources **Local Watershed Erosion** ☐ None ☐ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present ☐ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous dominant species present _____
INSTREAM FEATURES	Estimated Reach Length __100__ m Estimated Stream Width _____ m Sampling Reach Area _____ m² Area in km² (m²x1000) _____ km² Estimated Stream Depth _____ m Surface Velocity (at thalweg) _____ m/sec **Canopy Cover** ☐ Partly open ☑ Partly shaded ☐ Shaded **High Water Mark** __0.1__ m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle __80__ % ☐ Run __10__ % ☐ Pool __10__ % **Channelized** ☑ Yes ☐ No **Dam Present** ☐ Yes ☑ No
LARGE WOODY DEBRIS	LWD _____ m² Density of LWD _____ m²/km² (LWD/ reach area)
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☑ Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation __40__ %
WATER QUALITY	Temperature _____ °C Specific Conductance _____ Dissolved Oxygen _____ pH _____ Turbidity _____ WQ Instrument Used _____ **Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other _____ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☑ None ☐ Other _____ **Turbidity (if not measured)** ☑ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☐ Sand ☐ Relict shells ☐ Other _____ Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	15
Boulder	> 256 mm (10")	20			
Cobble	64-256 mm (2.5"-10")	30	Muck-Mud	black, very fine organic (FPOM)	0
Gravel	2-64 mm (0.1"-2.5")	~~40~~ 35			
Sand	0.06-2mm (gritty)	10	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	5			
Clay	< 0.004 mm (slick)				

STREAM NAME		LOCATION	
STATION # _SC1_ RIVERMILE_____		STREAM CLASS	
LAT _____ LONG _____		RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS			
FORM COMPLETED BY		DATE _5/13/13_ TIME _____ AM PM	REASON FOR SURVEY

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

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SC1

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Parameters to be evaluated broader than sampling reach

Total Score _____

Station
RC1

Total Hydropsychidae	Total Ephemeroptera	Total Scrapers	Total Chironomidae	Total PT	Abundance	Total Taxa	EPT Taxa
9.00	0.00	0.00	93.00	11.00	110.00	6.00	2.00

% Ephemeroptera	% PT less Hydropsychidae	% Scrapers	% Chironomidae	Two Dominant Taxa #	% Top two dominant taxa	FFG #	HBI (Family)
0.00	1.82	0.00	84.55	102.00	92.73		5.85

RC1

	VASCI Metrics vs. Standard	VASCI Metrics (Truncated)
Number of Taxa	27.27	27.27
Number of EPT Taxa	18.18	18.18
Percent E	0.00	0.00
Percent PT Less Hydropsychidae	5.11	5.11
Percent Scrapers	0.00	0.00
Percent Chironomidae	15.45	15.45
Percent Two Dominant	10.51	10.51
Hilsenhoff Biotic Index	61.03	61.03

Raw VASCI	Final VASCI
17.19	17.19

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME		LOCATION	
STATION # RC 1 RIVERMILE		STREAM CLASS	
LAT _____ LONG _____		RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS WB JR			
FORM COMPLETED BY		DATE 5-13-13 TIME _____ AM PM	REASON FOR SURVEY

WEATHER CONDITIONS	Now		Past 24 hours	Has there been a heavy rain in the last 7 days? ☒Yes ☐No
	☐	storm (heavy rain)	☐	
	☐	rain (steady rain)	☐	Air Temperature 50 °C
	☐	showers (intermittent)	☐	
	%☐	%cloud cover	☐ %	Other _____
	☒	clear/sunny	☒	

SITE LOCATION/MAP — Draw a map of the site and indicate the areas sampled (or attach a photograph)

+2
Crayfish

Pics 160-165

D   V

RC   0.4 _ 023 .246   pH   8.0

C   0.5 _ 0.40 .534   Cond 1380

LC   0.60 _ 0.78 1.25   DO   8.78

2.030 CFS

Width   8'   Temp   13.2

2.67 X L X W

STREAM CHARACTERIZATION	Stream Subsystem ☒Perennial ☐ Intermittent ☐ Tidal	Stream Type ☐ Coldwater ☒ Warmwater
	Stream Origin ☐ Glacial ☐ Spring-fed ☐ Non-glacial montane ☒ Mixture of origins ☐ Swamp and bog ☐ Other _____	Catchment Area _____ km²

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A-5

RC1

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☐ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other _____ ☐ Residential **Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☐ Obvious sources **Local Watershed Erosion** ☐ None ☐ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present ☑ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous dominant species present _____
INSTREAM FEATURES	Estimated Reach Length 100 m Estimated Stream Width _____ m Sampling Reach Area _____ m² Area in km² (m²x1000) _____ km² Estimated Stream Depth _____ m Surface Velocity _____ m/sec (at thalweg) **Canopy Cover** ☐ Partly open ☐ Partly shaded ☑ Shaded **High Water Mark** 0.33 m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle 80 % ☐ Run 0 % ☐ Pool 20 % Channelized ☑ Yes ☐ No Dam Present ☐ Yes ☑ No
LARGE WOODY DEBRIS	LWD _____ m² Density of LWD _____ m²/km² (LWD/ reach area)
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present ☐ Rooted emergent ☐ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☑ Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation 60 %
WATER QUALITY	Temperature _____ °C Specific Conductance _____ Dissolved Oxygen _____ pH _____ Turbidity _____ WQ Instrument Used _____ **Water Odors** ☑ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other _____ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☑ None ☐ Other _____ **Turbidity (if not measured)** ☑ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☑ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ **Oils** ☑ Absent ☐ Slight ☐ Moderate ☐ Profuse **Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☑ Sand ☐ Relict shells ☐ Other _____ Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	Diameter	% Composition in Sampling Reach	Substrate Type	Characteristic	% Composition in Sampling Area
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME		LOCATION	
STATION # RC1 RIVERMILE		STREAM CLASS	
LAT _____ LONG _____		RIVER BASIN	
STORET #		AGENCY	
INVESTIGATORS			
FORM COMPLETED BY		DATE 5/13/13 TIME _____ AM PM	REASON FOR SURVEY

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Parameters to be evaluated in sampling reach	**1. Epifaunal Substrate/ Available Cover**	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

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A-7

RC1

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Parameters to be evaluated broader than sampling reach

Total Score _____

Station
GF1

Total Hydropsychidae	Total Ephemeroptera	Total Scrapers	Total Chironomidae	Total PT	Abundance	Total Taxa	EPT Taxa
6.00	0.00	0.00	11.00	97.00	116.00	12.00	6.00

% Ephemeroptera	% PT less Hydropsychidae	% Scrapers	% Chironomidae	Two Dominant Taxa #	% Top two dominant taxa	FFG #	HBI (Family)
0.00	78.45	0.00	9.48	93.00	80.17		1.40

GF1

	VASCI Metrics vs. Standard	VASCI Metrics (Truncated)
Number of Taxa	54.55	54.55
Number of EPT Taxa	54.55	54.55
Percent E	0.00	0.00
Percent PT Less Hydropsychidae	220.36	100.00
Percent Scrapers	0.00	0.00
Percent Chironomidae	90.52	90.52
Percent Two Dominant	28.65	28.65
Hilsenhoff Biotic Index	126.47	100.00

Raw VASCI	Final VASCI
71.89	53.53

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(FRONT)

STREAM NAME Blody Fork	LOCATION
STATION # BF 1 RIVERMILE	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY WB / JR DATE 5-13-13 TIME 1400 AM PM	REASON FOR SURVEY

WEATHER CONDITIONS	
	Now **Past 24 hours** Has there been a heavy rain in the last 7 days? ☑ Yes ☐ No
	☐ storm (heavy rain) ☐
	☐ rain (steady rain) ☐ Air Temperature 50 °C
	☐ showers (intermittent) ☐
	___%☐ %cloud cover ☐ % Other _____
	☒ clear/sunny ☒

SITE LOCATION/MAP — Draw a map of the site and indicate the areas sampled (or attach a photograph)

Pics 148-153

Flow   pH   8.1

   D   V

LC   0.4 __ 0.91   1.700   DO   8.57

C   0.5 __ 2.18   5.09   Cond   551

RC   0.60 __ 1.05   2.942

width __ 14'   9.73 cfs   Temp   11.5

4.67 × D × V

STREAM CHARACTERIZATION	
Stream Subsystem ☒ Perennial ☐ Intermittent ☐ Tidal	**Stream Type** ☐ Coldwater ☒ Warmwater
Stream Origin ☐ Glacial ☐ Non-glacial montane ☐ Swamp and bog ☐ Spring-fed ☒ Mixture of origins ☐ Other ____	Catchment Area _____ km²

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PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET
(BACK)

GF1

WATERSHED FEATURES	**Predominant Surrounding Landuse** ☒ Forest ☐ Commercial ☐ Field/Pasture ☐ Industrial ☐ Agricultural ☐ Other _____ ☒ Residential	**Local Watershed NPS Pollution** ☐ No evidence ☐ Some potential sources ☒ Obvious sources **Local Watershed Erosion** ☐ None ☒ Moderate ☐ Heavy
RIPARIAN VEGETATION (18 meter buffer)	Indicate the dominant type and record the dominant species present ☒ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous dominant species present _____	
INSTREAM FEATURES	Estimated Reach Length __100__ m Estimated Stream Width __3.5__ m 4.5 Sampling Reach Area _____ m² Area in km² (m²x1000) _____ km² Estimated Stream Depth _____ m Surface Velocity _____ m/sec (at thalweg)	**Canopy Cover** ☐ Partly open ☐ Partly shaded ☒ Shaded **High Water Mark** __0.2__ m **Proportion of Reach Represented by Stream Morphology Types** ☐ Riffle __60__ % ☐ Run __30__ % ☐ Pool __10__ % Channelized ☒ Yes ☐ No Dam Present ☐ Yes ☒ No
LARGE WOODY DEBRIS	LWD _____ m² Density of LWD _____ m²/km² (LWD/ reach area)	
AQUATIC VEGETATION	Indicate the dominant type and record the dominant species present ☐ Rooted emergent ☒ Rooted submergent ☐ Rooted floating ☐ Free floating ☐ Floating Algae ☐ Attached Algae dominant species present _____ Portion of the reach with aquatic vegetation ____ %	
WATER QUALITY	Temperature _____ °C Specific Conductance _____ Dissolved Oxygen _____ pH _____ Turbidity _____ WQ Instrument Used _____	**Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other _____ **Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☒ None ☐ Other _____ **Turbidity (if not measured)** ☒ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other _____
SEDIMENT/ SUBSTRATE	**Odors** ☐ Normal ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Anaerobic ☐ None ☐ Other _____ **Oils** ☒ Absent ☐ Slight ☐ Moderate ☐ Profuse	**Deposits** ☐ Sludge ☐ Sawdust ☐ Paper fiber ☒ Sand ☐ Relict shells ☐ Other __Silt__ Looking at stones which are not deeply embedded, are the undersides black in color? ☐ Yes ☒ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	10
Boulder	> 256 mm (10")	16			
Cobble	64-256 mm (2.5"-10")	35	Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")	25			
Sand	0.06-2mm (gritty)	20	Marl	grey, shell fragments	
Silt	0.004-0.06 mm	10			
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME GF1	LOCATION
STATION #_____ RIVERMILE_____	STREAM CLASS
LAT _____ LONG _____	RIVER BASIN
STORET #	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE 5/13/13 TIME 1400 AM PM REASON FOR SURVEY

Parameters to be evaluated in sampling reach

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 (16)	15 14 13 12	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE	20 19 18 17 (16)	15 14 13 12	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE	20 19 18 (17)	15 14 13 12	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12	10 9 8 7 6	5 4 3 2 1 0

Rapid Bioassessment Protocols For Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition - Form 2

GF1

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Parameters to be evaluated broader than sampling reach

Total Score _____